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PATENT- OG VAREMÆRKESTYRELSEN

FASTENING DEVICE FOR ESTABLISHING A FASTENING CONNECTION BETWEEN AT LEAST TWO ELEMENTS, METHOD OF ESTABLISHING A FASTENING CONNECTION BETWEEN AT LEAST TWO ELEMENTS WITH A FASTENING DEVICE AND USE THEREOF.

Background of the invention

The present invention relates to a fastening device for establishing a fastening connection between at least two elements according to the preamble of claim 1, method of establishing a fastening connection between at least two elements with a fastening device and use thereof.

In order to fix and retain a given object to a location different fastening devices have been suggested and used through the ages. A very common way of fixation is the use of rope or steel wires in order to retain an object to a surface during transport e.g. a product to the platform of a lorry trailer or a goods wagon.

Shipping is another example of an area in which fixation and retaining of objects are very relevant. Especially, as transportation by ship usually requires more substantial fixation in order to retain the objects in place e.g. during frequently changing weather conditions. Various methods and devices have been suggested in order to secure the objects, such as containerized cargo, to the deck of a ship e.g. a containership.

Fig. 1a and 1b illustrate a common example of a modern containership seen from above and from the side, respectively. The containership comprises a number of containers located on the ship deck as well as below deck (not illustrated on the figures). To facilitate the carriage of a significant amount of containers the containers are closely stacked on deck in a height of several containers e.g. four containers on top of each other and four columns of containers across the ship deck as illustrated in fig. 2a.

Once the containership is at sea, the containership's pitching, yawing and particularly its rolling affects the container stacks. Especially, if the containership encounters heavy weather, it may experience rolls of as much as 30 degrees from vertical. The

rolling of the containership requires that the fixation is continuously redone in order to keep it tight and thus the containers secure on deck.

Fig. 2a further illustrates that space may be present between the top and bottom of the stacked containers e.g. due to pebbles, dirt or local unevenness of the containers. The space may also require that the fixation is redone in order to keep it tight.

Fig. 2b illustrates a well-known system of fixating and lashing containers to the deck or the hatch cover of a containership. The system is set up in traverse patterns over the faces of the containers and when containers are stacked, e.g. four or more high, double-height crosses that span two layers are superimposed on a bottom row of single-height crosses. The containers are also held together with twistlocks engaging with the top and bottom corners of containers positioned on top of each other. The twistlocks ensures that the upper container layers, which are not lashed by the system, stay in place.

The system comprises turnbuckles for tightening rods, chains and wire lashings tightening the containers to the ship deck. The tightening may be performed from deck level by a ship worker or assistant equipped with a turnbuckle spanner or a similar handling tool.

The spanner is used to engage and turn the body of the turnbuckle in a left or right direction whereby the left and the right screw threaded rods in the turnbuckle are turned closer or further apart.

A problem with the known system is the fact that modern containerships often carry thousands of containers on deck. The lashing of the deck containers involves numerous turnbuckles which all must be tightened during loading at port and frequently at sea in order to secure the container cargo from going overboard.

The tightening of the turnbuckles requires much man power and is obviously very time consuming, which is especially disadvantageous at port as many efforts have

been made by the owners of the containerships to minimize the time the ships are at port. The lashing is thus very costly in time and money for the companies that own the containerships.

A further problem is the fact that the turnbuckles often weigh between 10 and 25 kilograms. The workers thus carry a significant weight load at the lashing. After establishment of the lashing the workers are facing the demanding task of tightening the thousands of turnbuckles with turnbuckle spanners. The tightening of the turnbuckles must be performed in all kinds of weather and often under very cramped conditions, as the containers are stacked very close to each other.

The object of the invention is to create a fastening device and method without the above-mentioned drawbacks.

Especially, it is an object of the invention to create a fastening device and method which minimize the risk of industrial injuries to the workers using the device and method, e.g. to the workers arms and backs.

Summary of the invention

The invention relates to a holding device (20) comprising at least two holding parts (20a, 20b), each holding part including at least one surface comprising dents/grooves partly or totally corresponding to said corrugations, at least said frame (15) or said holding device (20) comprising an at least partly tapered shape, elastic means such as spring means (21) forcing said holding device (20) against said frame (15) and thereby said holding parts (20a, 20b) against each other.

Hereby, it is possible to create a secure fastening of elements to each other in a faster and easier way.

It shall be emphasized that the elastic means of the fastening device may be any suitable elastic or bouncing means such as any type of springs, rubber, hydraulic or pneumatic means such as shock absorbers.

When, as stated in claim 2, said fastening device includes a second rod (25, 27) with shock absorbing spring means (26) such as a number of plate springs forced against said frame (15), it is possible to absorb brief shock forces transmitted to the fastening device from the secured elements.

Hereby the stress, which is put on the fastening device and the rest of the fastening system, is significantly reduced. Further, the need for tightening the fastening device is also reduced as the brief forces are not fully transmitted to the fastening system as such and thus cannot create slack in the system.

The shock absorbing spring means may be replaced by hydraulic or pneumatic suspension means.

When, as stated in claim 3, said frame (15) comprises two vertical frame walls (15a, 15b) connected in an upper end by a horizontal wall (19) comprising contact surface for said holding device (20), in the lower end by a second horizontal wall (22b) comprising contact surface for said shock absorbing spring means (26) and in between by a third horizontal section (22) comprising contact surface for said spring means (21) forcing said holding device (20) against said contact surface of said frame, it is possible to create a very rigid fastening device.

The more rigid fastening device allows the frame construction to be lighter than normal. With the lighter frame construction the industrial injuries to the workers are minimised as they carry less weight during a workday.

When, as stated in claim 4, said holding device (20) includes release spring means (36) in between said surfaces comprising dents/grooves, it is possible to force the holding parts from each other if the parts are not held in place by the frame.

Hereby a ratchet effect is achieved when the rod encounters a downward force. The effect allows the rod to move to a lower level and thus an automatic tightening of the fastening device is achieved.

As the fastening device tights itself during normal use the risk of industrial injuries to the workers is minimised since less tightening has to be done manually.

When, as stated in claim 5, said frame (15) and/or said holding device (20) comprise a substantially conical, frustoconical, triangular, pyramidical or a similar tapered shape, a secure hold on the rod may be established. By forcing the tapered shapes on the frame and/or the holding device against each other the holding device is also forced against the rod. The more they are forced against each other the harder is the hold on the rod.

It should be emphasised that the frame may comprise a non-tapered shape if the holding device comprises a tapered shape and vice versa e.g. a vertical opening in the frame. The tapered shape of the holding device may then be forced against the edges of the vertical opening and thus against the rod.

When, as stated in claim 6, said dents/grooves of said surface are reversed frustoconical shaped and/or said rod (18) with corrugations comprises reversed frustoconical sections establishing the corrugations, it is possible to create a secure hold on said rod with the holding parts due to the large horizontal attack surfaces on the rod and the dents/grooves.

When, as stated in claim 7, said rod (18) and/or said holding device (20) comprise contact surfaces for handling tools, an advantageous embodiment of the invention has been achieved.

The manual tightening or releasing of the fastening device may be performed by applying a force with the handling tool engaging the contact surface on the fastening device. The force is directed up or down with the handling tool thereby reducing the

risk of industrial injuries to the workers further as rotating movements are avoided in the tightening or releasing process.

The tightening or releasing process in connection with the fastening device is also less time consuming as it involves one continuous movement instead of several rotating movements.

This means that fewer workers are needed to lash the cargo at port and sea.

The continuous movement also means that lubricant is not necessary or may be reduced in contrast to systems involving rotating movements.

When, as stated in claim 8, said spring means (21) is a helical spring, a uniform pressure may be established on the holding parts. Hereby, it is possible to hold the holding parts against corrugated rod with a uniform pressure and thus not forcing the rod to one side.

When, as stated in claim 11, use of a fastening device according to any one of the claims 1 to 8 and method of establishing a fastening connection between at least two elements according to claim 9 or 10 in relation with fastening of cargo such as lashing of shipping containers, a preferred embodiment is achieved.

By using the fastening devices in relation to fastening of cargo on ships it is possible to minimize the time that is used on deck fastening and subsequently refastening the devices, as they are self-tightening. This involves a number of economical advantages to the shipping company.

Further, by reducing the time spent on deck the number of accidences may also be reduced.

The figures

The invention will be described in the following with reference to the figures, in which

figs. 1a and 1b illustrate a modern containership seen from above and from the side,

fig. 2a illustrates a section of containers stacked before lashing,

fig. 2b illustrates a well-known system of lashing a section of containers to the deck or hatch cover of a containership,

figs. 3a to 3c illustrate a preferred embodiment of a fastening device according to the invention in a front view, a side view and a top view,

fig. 4a illustrates a front view of a section of the fastening device according to the invention,

fig. 4b illustrates a cross section of the fastening device illustrated in fig. 4a,

fig. 5a illustrates a cross section of the first and second holding parts of the invention,

fig. 5b illustrates the first and second holding parts of the invention seen from above,

fig. 6 illustrates a preferred embodiment of the fastening device according to the invention in a normal place of use,

fig. 7 schematically illustrates the functionality of the fastening device according to the invention at port and at sea,

figs. 8a and 8b illustrate an embodiment of a handling tool and use thereof in connection with fastening device according to the invention,

figs. 9a and 9b illustrate further embodiments of the fastening device according to the invention, and

fig. 10 illustrates an even further embodiment of the fastening device according to the invention .

Detailed description

Fig. 1a and 1b illustrate an example of a modern multipurpose containership 1 with a number of shipping containers 2 located on the ship deck as well as below the ship deck 4 (not illustrated on the figures). The ship is further illustrated with a ship bridge 6 and a number of ship cranes 3 used to load and unload the containers 2.

The shipping containers are metal boxes used for the carriage of almost any type of cargo. Usual dimensions are 20 x 8 x 8.5feet or 40 x 8 x 8.5feet.

The containers stored below deck in the containership's hull 8 may be held in place entirely by built-in "cell structures".

The containers located on deck require lashing systems that secure the containers 2 to the ship deck 4 or to the ship hatches 5.

If the containers are stacked only two containers high, locking cones may be used as the only fastener device. The locking cones fit into receptacles at the corners of the containers, attaching each container to the deck or to the container right below. The cones generally have a twist-lock to resist the above-mentioned upward and sideways thrusts.

Fig. 2a illustrates a section of containers in which the containers are stacks of four containers on top of each other and in four stacks. In order to secure the section of containers to a ship's deck a lashing system has to be added.

Fig. 2a further illustrates that space 13 may be present between the top and bottom of the stacked containers 2 e.g. due to pebbles, dirt or local unevenness of the containers.

Fig. 2b illustrates the section of containers from fig. 2a with the added lashing system.

The system is set up in traverse patterns over the faces of the containers and when containers are stacked, e.g. four or more high, double-height crosses that span two layers are superimposed on a bottom row of single-height crosses.

The system comprises turnbuckles 9 in which each turnbuckle is a link or sleeve with an internal screw thread at each end, one right handed and the other left handed. The turnbuckle function as a means of uniting or coupling and of tightening two parts at the ends of two rods. One rod is connected to a tightening rod, chain or wire lashing 11 and the other to an anchoring point 10 on the ship deck or hatch.

The tightening rod is in its opposite end connected to a securing pad 12 that fits into receptacles at the corners of the containers.

A ship worker or assistant 7 equipped with a turnbuckle spanner or a similar handling tool may perform the tightening of the turnbuckles from deck level. The spanner is used to engage and turn the link or sleeve of the turnbuckle in a left or right direction whereby the left and the right screw threaded rods in the turnbuckle are turned closer or further apart.

Fig. 3a illustrates a preferred embodiment of a fastening device 14 according to the invention in a front and upright view.

The fastening device comprises a substantially tubular frame 15 with two vertical slot openings dividing the frame into two frame walls or sections 15a, 15b. The frame further comprises internal openings at each end. A first internal opening is positioned in an internally tapered section 19 of the first end of the frame 15. In the opening a rod is positioned with corrugations 18, said opening allowing the rod to move up and down inside the frame in the present view.

The internal tapered section 19 of the first end of the frame 15 preferably has the shape of a cone or a frustocone pointing up against the first internal opening.

The rod 18 ends in a hook 16 with a locking bar 17, allowing the connection of the fastening device 14 through the hook to an element or a first part e.g. an eyelet of a tightening rod, chain or wire lashing. After positioning the eyelet in the hook the locking bar may be forced into a locked position e.g. by spring means and thus ensuring that the eyelet stays in place.

The rod 18 includes a number of corrugations in most of its vertical extension. Each of the corrugations is a triangular rim stretching out from the rod, the topside of the rim creating a substantially horizontal surface or platform. Each of the corrugations may also be described as a reversed frustoconical section.

The rod 18 also includes an end stop 24 in the opposite end ensuring that the rod does not move past a wall 22a. The wall 22a is a horizontal plate with a central hole allowing the rod 18 to move until the end stop reaches the wall from beneath. The wall also connects the two frame sections 15a, 15b and works as a contact surface or backpressure wall for a helical spring 21. The spring is pressed up against the underside of a holding device 20 comprising two holding parts 20a, 20b.

The top of the holding parts together form the shape of a cone pointing upward and corresponding to the internal tapered section 19 of the first end of the frame 15. The two surfaces of the holding parts facing each other include dents/grooves corresponding to the corrugations of the rod (as further illustrated and explained in connection with fig. 4b and 5b).

As explained above the helical spring 21 is pressed up against the underside of the holding device 20 comprising two holding parts 20a, 20b, and the conical top of the holding parts is thereby pushed into and against the tapered section 19 of the first end of the frame 15. Further, the two surfaces of the holding parts facing each other are forced against each other as the cone top engages the tapered section. Thus, the dents of the holding parts also engage with the corrugations of the rod and hold it in place.

The second internal opening is positioned in the opposite end of the frame 15 and allows a bolt 27, with a bolt head or an end nut 25 in one end, to enter and be retained in the frame. The other end may comprise a hook or an eyelet allowing the fastening device to be secured to another element or part such as a ship deck or ship hatch. Between the bolt head or end nut 25 and the frame a number of shock absorbing plate springs 26 is positioned, e.g. three plate springs. The plate springs preferably pressed against a contact surface on top of a horizontal plate 22b with a central hole connecting the frame sections 15a, 15b. The hole allows the bolt 27 to move primarily under the restriction of the plate springs and the bolt head or end nut 25.

Fig. 3b illustrates the preferred embodiment of the fastening device 14 according to the invention in a side and upright view.

The frame section 15b is illustrated as a single vertical plate connected with the other frame section 15a through the tapered section 19 and the horizontal plates 22a, 22b creating a rigid frame structure for the fastening device 14.

Fig. 3c illustrates the preferred embodiment of the fastening device 14 according to the invention seen from above.

As seen in the figure the fastening device has a tubular shape with the rod 18 positioned in the center of the fastening device.

The frame 15 and the holding device 20 may as mentioned above comprise a substantially conical or frustoconical shape. However, the shape may also be triangular, pyramidical or a similar tapered/frustum shape.

In a further embodiment of the invention only one of the frames 15 and the holding device 20 comprises a tapered shape, e.g. the holding device, while the frame internally has vertical walls that the tapered holding device is forced up against. The edges of the vertical walls will force the holding parts of the holding device against each other.

Fig. 4a illustrates a front view of a section of the fastening device according to the invention.

The section includes the internal tapered section 19, the holding device 20 comprising the two holding parts 20a, 20b, a section of the rod 18 as well as the helical spring 21 and the horizontal wall 22a.

As it is seen in the figure each of the holding parts 20a, 20b substantially surrounds - from the side - half of a section of the rod 18.

Fig. 4b illustrates a cross section of the front view in fig. 4a.

The holding parts 20a, 20b are both illustrated with a top section 32 having a conical shape corresponding to the shape of the internal tapered section 19 of the frame 15. The top sections of the holding parts are cone halves that together substantially form a full cone. The cone halves are forced up against the internal tapered section 19 by

the helical spring 21 and as a result of this the holding parts are also forced in an inward direction against each other and against the rod centred between them.

The surfaces facing the rod have a number of dents/grooves with a triangular cross section reversely corresponding to the corrugations of the rod. With the underside of the triangular dents having a substantially horizontal surface or platform, it is possible for the dent to engage closely and firmly with the corrugations of the rod as illustrated in the figure.

Beneath the conical top the holding parts comprise an area with a vertical contact surface 33. The area is limited above and below by edges that stretches out allowing for a release and tightening handling tool to engage with the surface and at the same time push against one or both of the limiting edges.

An example of a release and tightening tool and the functionality of the tool is illustrated in fig. 8a and 8b and described in details below.

As illustrated in fig. 4a and 4b the helical spring 21 is pressed against the wall 22a and against the holding parts 20a, 20b. In fig. 4b it is further illustrated that the spring is held in place by dents 34 in the underside of the holding parts. The dents create a circular space for a top part of the spring and are only limited in outward direction by a vertical wall.

Fig. 5a illustrates a cross section of the first and second holding part according to the invention.

In the figure it is further illustrated with holding parts forming half parts to surround the rod with corrugations. Further, the triangular dents of the holding parts are illustrated in a way that clearly indicates how they reversely correspond to the corrugations of the rod.

In order to facilitate the separation of the holding parts when they are forced out of the internal tapered section 19 of the frame, two release springs 36 are positioned in spring enclosure parts 37a, 37b of the lower part of the holding parts. The openings of the enclosures 37a, 37b are positioned in the surfaces of holding parts which face each other and close to the edge of the holding parts – preferably in or in proximity of the wall enclosing the dents 34 of the helical spring 21.

Fig. 5b illustrates that each of the release springs 36 stretches from the first enclosure part 37a through the opening between the holding parts 20a, 20b and into the second enclosure part 37b.

The two figures further illustrate that the holding parts 20a, 20b are forced from each other at the lower ends. The separation allows the rod corrugations to disengage with the dents of the holding parts and thus move freely up and down. When the force is removed, the helical spring will once again force the holding parts against the internal tapered section and against the rod while squeezing the release springs together.

Fig. 6 illustrates a preferred embodiment of a fastening device according to the invention in a normal place of use. The use involves a container ship deck or hatch 10 in which two containers 2 are positioned on top of each other.

The invention is a part of the lashing system, which is set up in traverse patterns over the faces of the containers from deck or hatch to the receptacles at the lower corners of the upper container. The lashing system also comprises lashing bars, securing pads etc. as described above in connection with well-known lashing systems.

If the upper container tries to move away from the deck or hatch the lashing system will substantially retain it in its position as the fastening device only allows small movement upwards by squeezing the plate springs together. The rod with corrugations is held in place by the holding devices. These are forced against the internal tapered section 19 of the frame 15 by the movement and thus held in place.

When the container returns to its normal position the plate springs will return to a non-actuated position.

However, if the container is coming closer to the deck or the hatch, e.g. due to removal of pebbles, dirt or local unevenness of the containers, the lashing bar will transfer the movement to the rod with corrugations. The rod will move downwards and push the holding devices down 20a, 20b. The holding devices will squeeze the helical spring together allowing the holding devices to ease their hold on the corrugations of the rod by moving away from each other. When the holding devices are sufficiently pulled apart the corrugations of the rod may be moved down through the dents of the holding devices as a kind of ratchet.

When the downward movement of the rod is stopped the helical spring 21 will once more force the holding devices 20a, 20b against the internal tapered section 19 and against the rod. The rod will once again be held in place by the holding devices but in a lower position than before and the lashing system has been tightened. The container is once more secured but in position closer to the deck or hatch.

Fig. 7 schematically illustrates the functionality of a fastening device according to the invention at port and at sea. The fastening device may be a part of a container fastening system on a container ship.

The functionality is at port 44:

A) The fastening device 14 is connected to an anchor point in the ship deck, hatch or similar ground plane 43 by a spring actuated bolt 41. The spring-actuated bolt is illustrated with a schematic indication of a balance lever 41 moving in relation to a preferred balance position 42. The preferred position may be seen as a position in which the lashing system is tight without damaging the spring of the bolt.

In the present situation the bolt is pushed upward by the spring as the fastening system is connected to the deck or hatch but not yet to the rest of the lashing system (illustrated by the bar 11).

The balance lever 41 is high above the preferred balance position 42.

B) The fastening device 14 is connected to the rest of the lashing system 11 but not yet tightened. The rod with corrugations 18 is in its most extracted position whereas the bolt head 41 is beginning to squeeze the spring 26 together.

The balance lever 41 is moving closer to the preferred balance position 42.

C) The lashing system is tightened by the handling tool forcing the rod downwards until the preferred position is reached.

The balance lever 41 is levelled at the preferred balance position 42.

The functionality is at sea 45:

D) The container is secured and not moving. The fastening device is in a non-actuated situation.

The balance lever 41 remains at the preferred balance position 42.

E) The container is coming closer to the ground plane 43 and the rod 18 is pushed downwards. The holding parts are forced apart allowing the parts to let go on the rod and thus the rod to move down to a lower position.

The balance lever 41 moves slightly above the preferred balance position 42 absorbing a bit of the slack in the fastening system.

F) The container is trying to move up in relation to the ground plane 43 and the force is transferred to the rod. The rod tries to move but is held in place by the holding devices that are forced against the frame of the fastening device.

The balance lever 41 moves slightly below the preferred balance position 42 absorbing the shock of the force.

G) The container has stopped moving. The fastening device is in a non-actuated situation.

The balance lever 41 returns to the preferred balance position 42 but with the rod in a lower position.

The vertical motion behaviour of the fastening device is schematically indicated by the curve 40 in which it is seen that the fastening device at sea moves from a stable level "c" to a stable level "b" over temporary levels "a" and "e" when the container moves up and down or vice versa.

Fig. 8a illustrates an embodiment of a handling tool to be used in connection with a fastening device according to the invention.

The handling tool 46 comprises a spanner with a tool shaft with offset jaw parts 47, 49 in each end. The two jaw parts are illustrated with different jaw sizes in order to engage both a release and a tightening section of the fastening device if these sections have different proportions. The release jaw 47 is illustrated with a larger jaw size compared with the size of the tightening jaw 49.

Fig. 8b illustrates the use of the handling tool 46 of fig. 8a in connection with the fastening device 14 according to the invention. The handling tool is illustrated in a first and second position of use.

In the first position the release jaw 47 engages with the contact surface 33 of one holding part 20a or both holding parts 20a, 20b. The other end of the handling tool is pushed down, e.g. by a ship worker, and hereby forcing the holding parts 20a, 20b downwards. As the holding parts are forced down their capability to engage with the corrugations of the rod is reduced until the rod is free to move e.g. upward. In a preferred embodiment the holding parts are forced apart by a spring e.g. as illustrated in figs. 5a and 5b.

In the second position the tightening jaw 49b engages with the rod just above the end nut. By forcing the handling tool downwards it is possible to pull the rod and the handling devices downward. The corrugations of the rod are pulled down through the dents of the holding parts as a kind of ratchet. When the force from the handling tool is removed the rod is once again held by the holding parts and hereby securing that the rod cannot move upwards to the previous position.

Fig. 9a illustrates details and further embodiments of the fastening device according to the invention.

The hook 50 of the rod includes a spring biased locking bar that is pivotally suspended by an axle 58. The locking bar is illustrated in a locked position in which an eyelet 54 of a lashing bar or wire is detained.

The figure is illustrated with a rod having at least one vertical non-corrugated section 51 from end stop to hook. The section may be a slot pressed into the rod or a smooth strip stretching out and e.g. being in-line with or past the corrugations.

Fig. 9b illustrates a section of the further embodiments.

The locking bar 56, 57 comprising a first section illustrated in a release position in which it is forced by pushing another section of the locking bar back and away from a hook ending 58. The locking bar 56, 57 pivots around an axle 58 in an opening 59 of the hook 50.

The hook ending 55 has a slot, which the locking bar 57 enters when it is in a locked position (illustrated with dotted lines) detaining the eyelet of the lashing bar or wire 54.

The figure further illustrates that the hook comprises an internal thread that may be screwed onto a thread (not illustrated on the figures) on the rod with corrugations and thus securing the hook onto the rod.

In another embodiment the connection between the rod and a lashing bar may be established with a spigot-and-socket joint or a similar fixed connection between the rod and bar.

Figs. 9a and 9b both illustrate that the locking bar has a rising shape toward the hook ending 55. When the locking bar is in a locked position the eyelet 54 may in some situations push downwards against locking bar. The push will force the locking bar against the hook ending 55 due to the shape and thus retaining the locking bar in the locked position instead of forcing it toward the release position.

Fig. 10 illustrates an even further embodiment of the fastening device according to the invention.

The rod with corrugations has a first length but continues as a further rod 61 with a second length with a smooth surface and hereby establishing a combination including the rod with corrugations and a lashing bar ending in a hook 62 for opening in container corners. The combined rod is preferably made in one metal bar that subsequently is supplied with corrugations etcetera.

Most of the components in the fastening device are preferably made of metal such as steel, iron or aluminium. In some embodiments the fastening device may however also be constructed partly or totally in plastic materials or similar materials. If a

higher degree of strength than possible with plastic materials is required, glass fibre materials or other fibrous enforced material such as coal fibre materials may be used.

The springs of the fastening device may be replaced with other elastic or bouncing means such as sections of rubber instead of the helical spring 21 or a hydraulic or pneumatic shock absorber instead of disk springs 26, 52.

Further choices among similar materials to construct the fastening device are possible; these choices will however be obvious to a skilled person within the art.

The invention can also be used in connection with fastening any other cargo that is not carried in a container. Such as cargo that is palletised, bagged, baled, bundled, crated, etc. Further, the invention may be used for holding an anchor tight, a stay of a mast or like maritime situations in which there is a need of fastening and tightening two parts.

Even further the invention can be used in other situations that need fastening and tightening of two parts e.g. electricity pylons, mobile communication antennas or similar high constructions that need to be secured to the ground.

It will also be understood that the invention is not limited to the particular examples described above but may be designed in a multitude of varieties within the scope of the invention as specified in the claims

List

1. container ship
2. shipping container
3. ship crane
4. ship deck
5. ship hatch
6. ship bridge
7. ship worker or assistant
8. ship hull
9. turnbuckle
10. anchoring point on deck or hatch used to hold the foot of a turnbuckle
11. lashing bar
12. securing pads
13. space between stacked containers
14. fastening device

15, 15a, 15b. frame walls, frame sections

16. hook
17. locking bar
18. rod with corrugations
19. horizontal wall comprising a tapered section of the frame
20. holding device

20a, 20b. holding parts engaging with the corrugations of the rod

21. helical spring

22a, 22b. horizontal walls for spring means

23. frame walls
24. end stop of the rod with corrugations
25. end nut or bolt head
26. shock absorbing disk springs
27. bolt
28. opening for a spring
29. vertical openings in the frame

30. conical surface substantially corresponding to the internal shape of the tapered section
31. corrugations substantially corresponding to the corrugations of the rod
32. tapered section of the holding parts
33. contact surface for a handling tool
34. encircled space posing as contact surface for the helical spring
35. corrugations section in the holding parts
36. release springs
37a, 37b. spring enclosure parts
38. connection between the fastening device and a lashing bar or wire
39. anchoring point on deck or hatch used to hold the foot of the fastening device
40. schematic indication of a vertical motion behaviour of the fastening device
41. schematic indication of a balance lever
42. schematic indication of a balance position
43. schematic indication of a ship deck, hatch or similar ground surface
44. port
45. sea
46. handling tool with two offset jaw parts
47. release jaw part of the tool
48. tool shaft
49. tightening jaw part of the tool
50. hook
51. non corrugated section in the rod
52. disk springs
53. eyelet
54. eyelet of lashing bar or wire
55. hook ending with a slot for a locking bar
56. first section of locking bar
57. second section of locking bar
58. axle

59.	opening
60.	thread
61.	combined rod with corrugations and lashing bar
62.	hook engaging with openings in container
a to e.	different positions in the vertical motion behaviour of the fastening device
A to G.	different states of the fastening device

Patent Claims

1. Fastening device (14) for establishing a fastening connection between at least two elements () comprising

a frame (15) having at least one opening and a connection (27) to one of said at least two elements,

a rod (18) with corrugations, said rod being movable through said at least one opening and including a connection to one of said at least two elements,

c h a r a c t e r i s e d i n t h a t

a holding device (20) comprising least two holding parts (20a, 20b), each holding part including at least one surface comprising dents/grooves partly or totally corresponding to said corrugations,

at least said frame (15) or said holding device (20) comprising an at least partly tapered shape,

elastic means such as spring means (21) forcing said holding device (20) against said frame (15) and thereby said holding parts (20a, 20b) against each other.

2. Fastening device according to claim 1, c h a r a c t e r i s e d i n t h a t said fastening device includes a second rod (25, 27) with shock absorbing spring means (26) such as a number of plate springs forced against said frame (15).

3. Fastening device according to claim 1 or 2, c h a r a c t e r i s e d i n t h a t said frame (15) comprises two vertical frame walls (15a, 15b) connected in an upper end by a horizontal wall (19) comprising contact surface for said holding device (20), in the lower end by a second horizontal wall (22b) comprising contact surface for said shock absorbing spring means (26) and in

between by a third horizontal section (22) comprising contact surface for said spring means (21) forcing said holding device (20) against said contact surface of said frame.

4. Fastening device according to one or more of the preceding claims, characterised in that said holding device (20) includes release spring means (36) in between said surfaces comprising dents/grooves.

5. Fastening device according to one or more of the preceding claims, characterised in that said frame (15) and/or said holding device (20) comprises a substantially conical, frustoconical, triangular, pyramidal or a similar tapered shape.

6. Fastening device according to one or more of the preceding claims, characterised in that said dents/grooves of said surface are reversed frustoconical shaped and/or said rod (18) with corrugations comprises reversed frustoconical sections establishing the corrugations.

7. Fastening device according to one or more of the preceding claims, characterised in that said rod (18) and/or said holding device (20) comprises contact surfaces (24, 33) for handling tools.

8. Fastening device according to one or more of the preceding claims, characterised in that said spring means (21) is a helical spring.

9. Method of establishing a fastening connection between at least two elements with a fastening device, said method comprising the steps of:

connecting a frame of said fastening device to one of said at least two elements and a rod with corrugations to the second of said at least two elements, said rod being movable through at least one opening of said frame,

engaging said rod with corrugations by at least two holding parts of a holding device, at least said frame or said holding device comprising an at least partly tapered shape,

forcing said holding device against said frame by elastic means such as spring means and thereby forcing said holding parts against each other.

10. Method according to claim 9, wherein said holding device or said rod with corrugations is released or tightened by a handling tool engaging with contact surfaces of said holding device or said rod with corrugations.

11. Use of a fastening device according to any one of the claims 1 to 8 and method of establishing a fastening connection between at least two elements according to claim 9 or 10 in relation with fastening of cargo such as lashing of shipping containers.

Abstract:

The invention relates to a fastening device (14) for establishing a fastening connection between at least two elements. The fastening device comprises a frame (15) having at least one opening and a connection (27) to one of said at least two elements. Further, it comprises a rod (18) with corrugations, said rod being movable through said at least one opening and it includes a connection to one of said at least two elements and a holding device (20) comprising at least two holding parts (20a, 20b), each holding part including at least one surface () comprising dents/grooves partly or totally corresponding to said corrugations. Even further, at least said frame (15) or said holding device (20) comprises an at least partly tapered shape, and elastic means such as spring means (21) forcing said holding device (20) against said frame (15) and thereby said holding parts (20a, 20b) against each other.

The invention also relates to a method of establishing a fastening connection between at least two elements with a fastening device, and use hereof.

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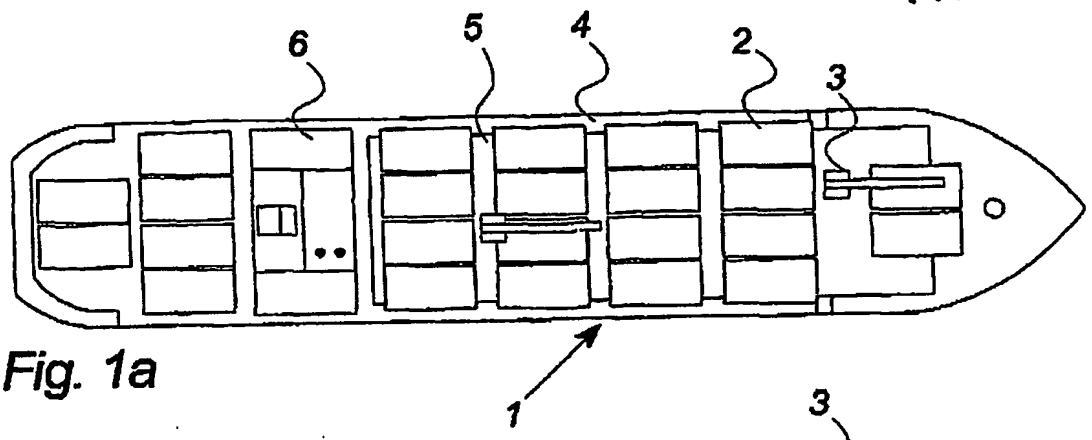

Fig. 1a

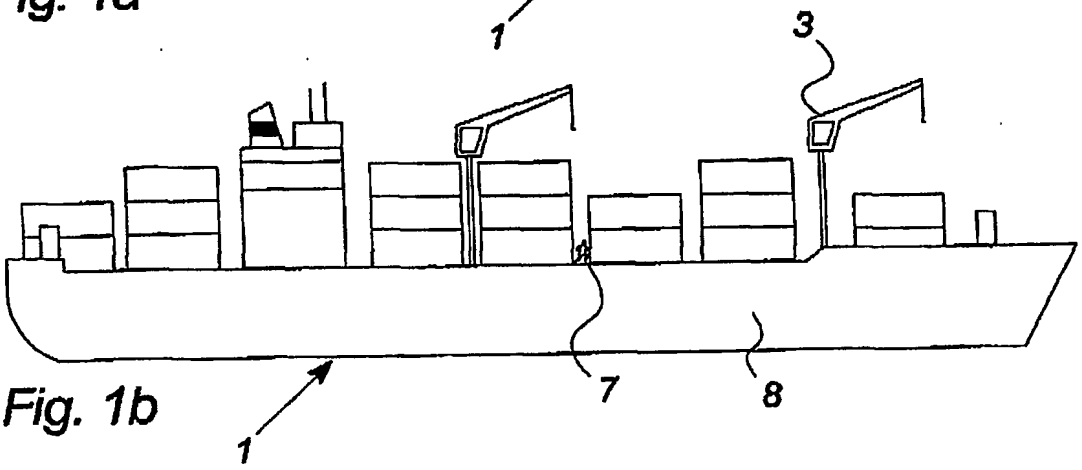

Fig. 1b

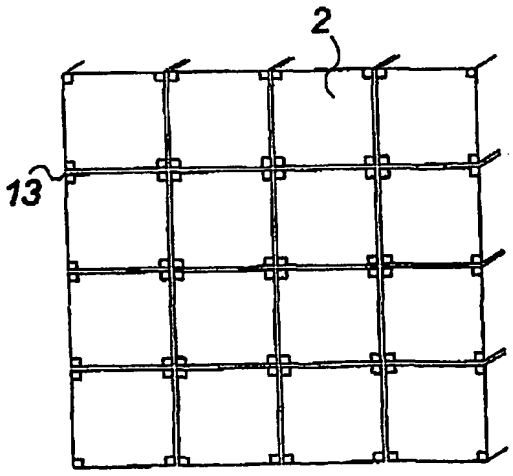

Fig. 2a

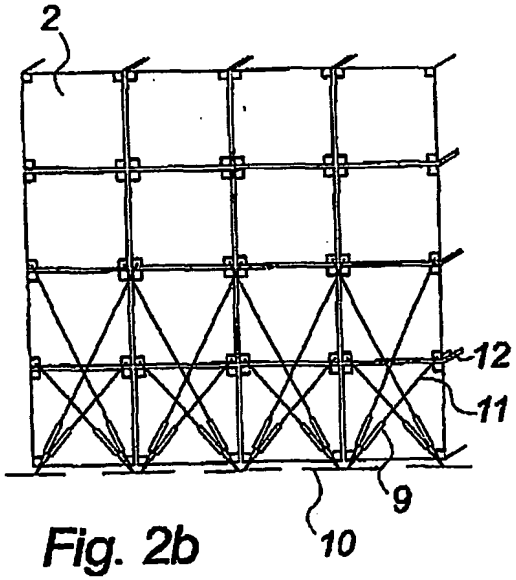

Fig. 2b

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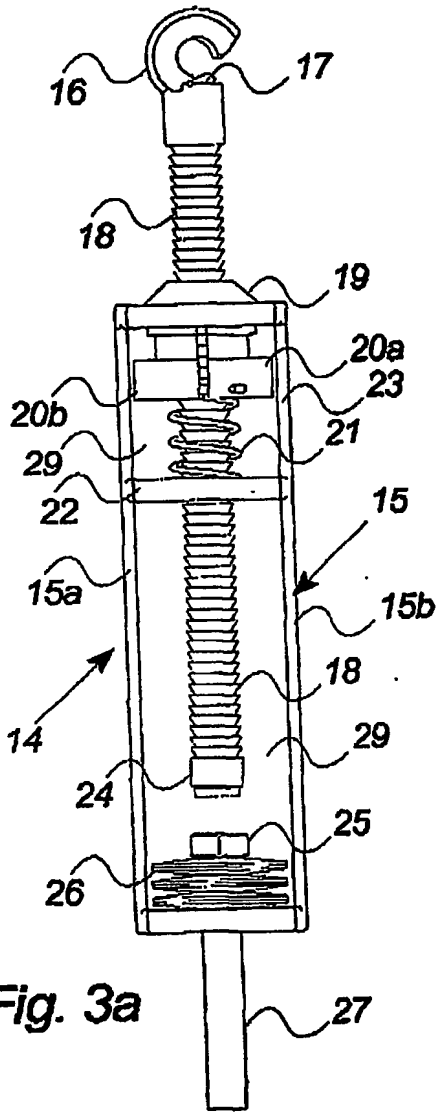

Fig. 3a

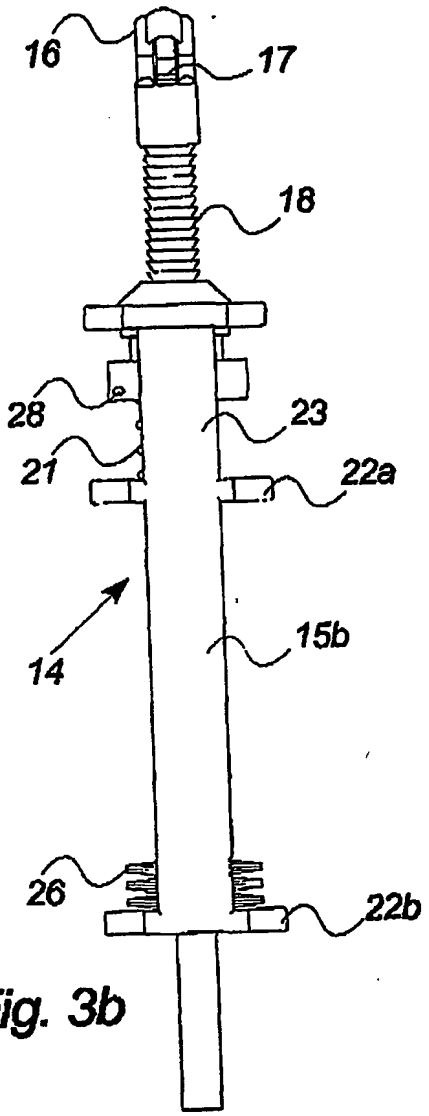

Fig. 3b

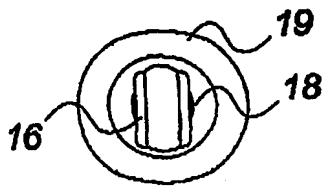

Fig. 3c

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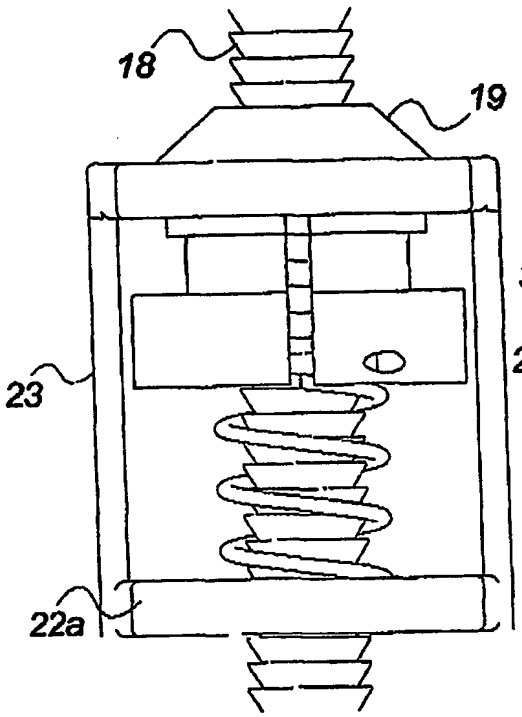

Fig. 4a

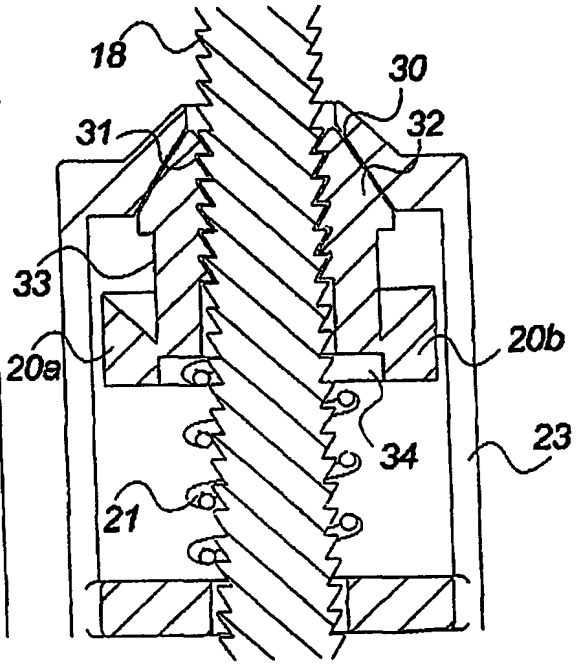

Fig. 4b

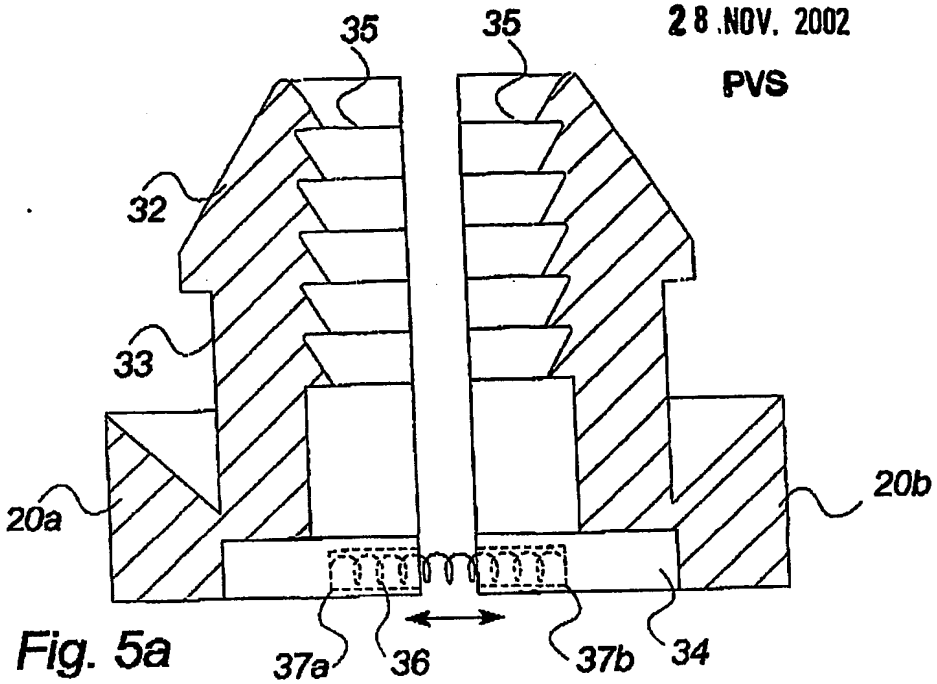

Fig. 5a

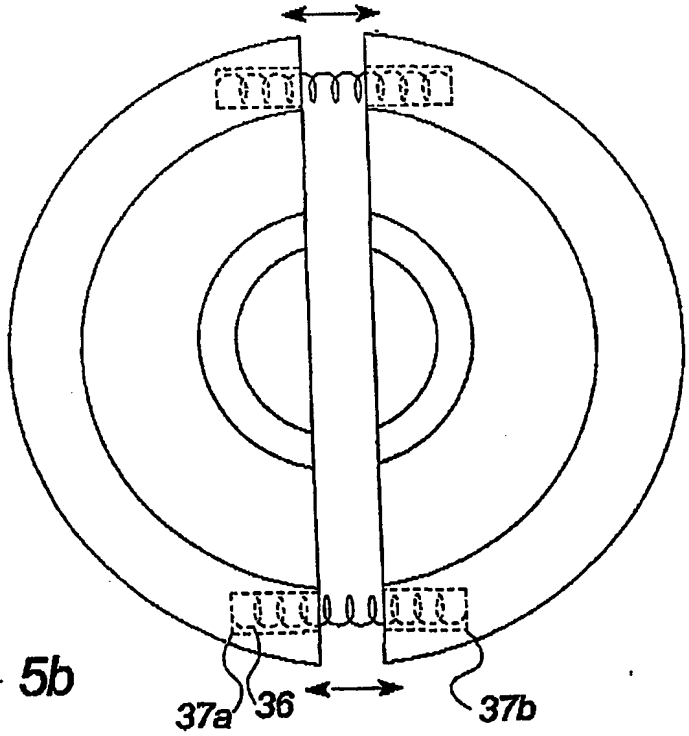

Fig. 5b

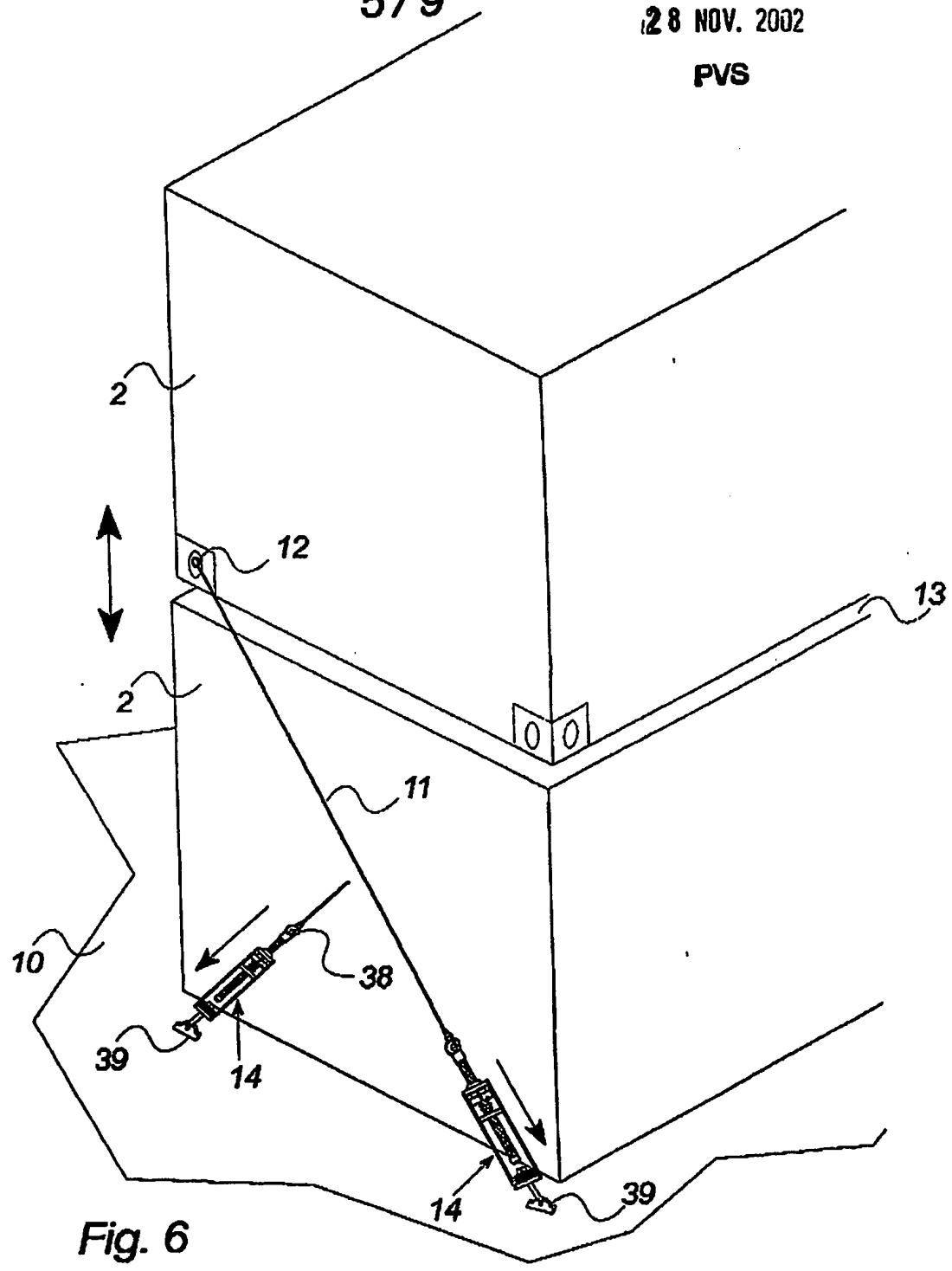

Fig. 6

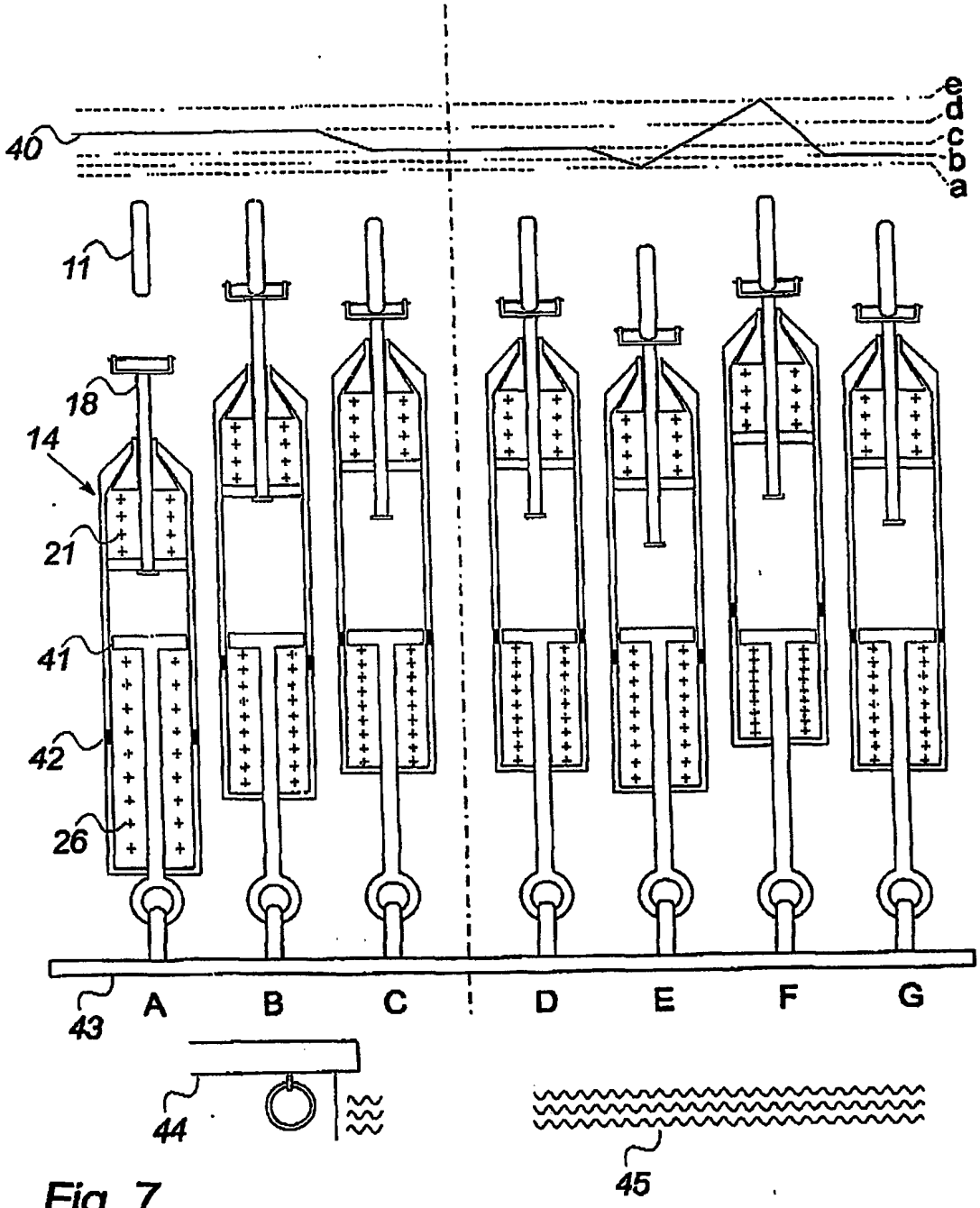

Fig. 7

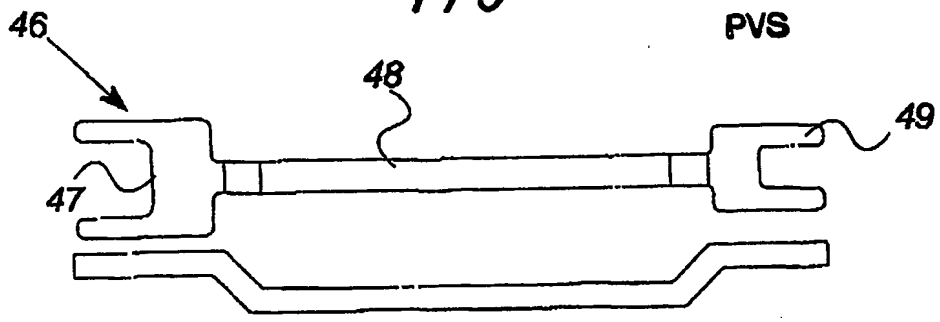

Fig. 8a

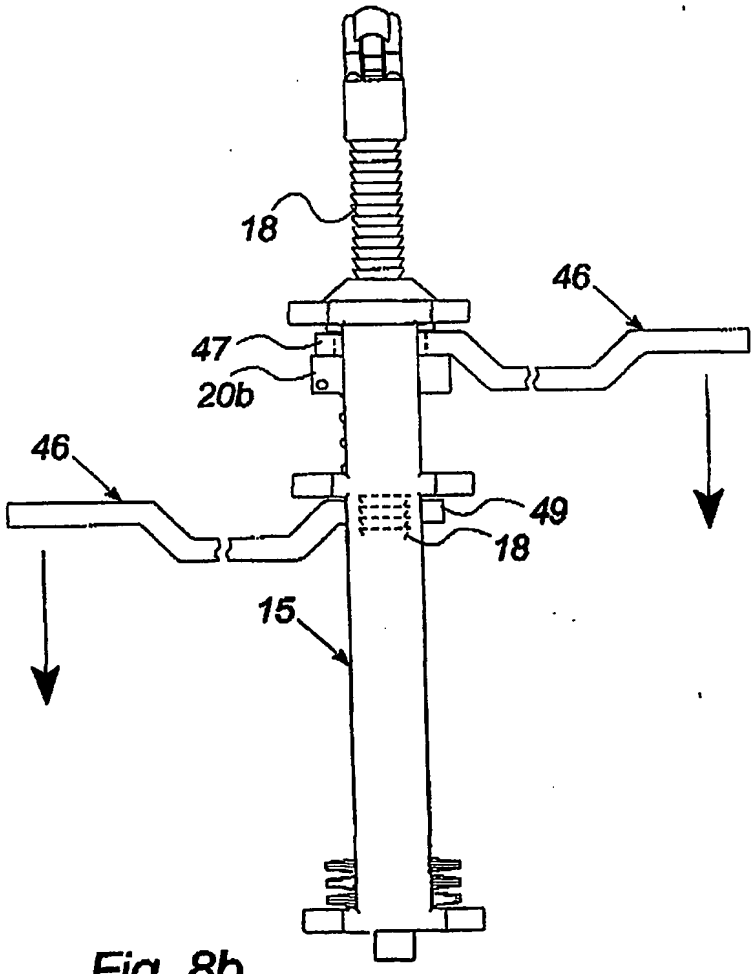

Fig. 8b

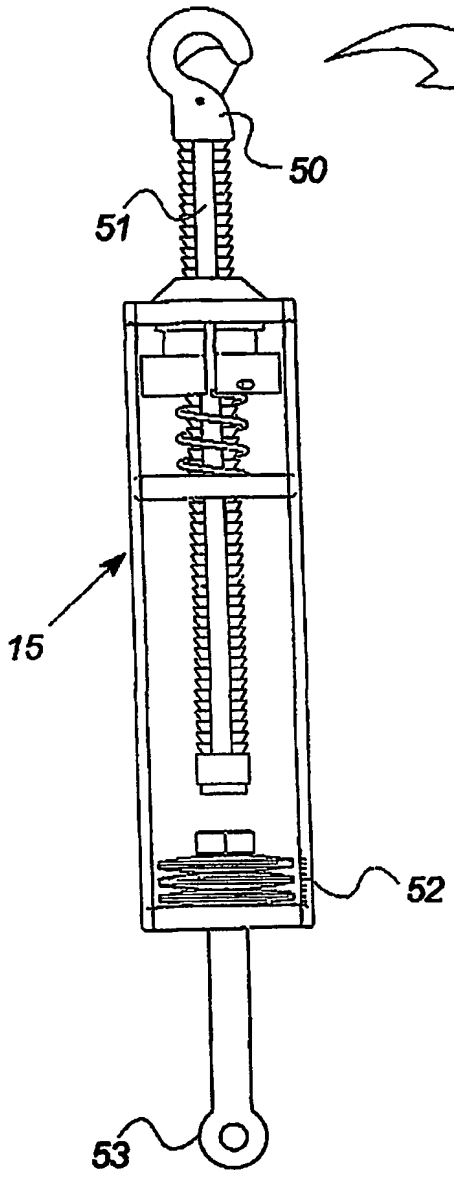

Fig. 9a

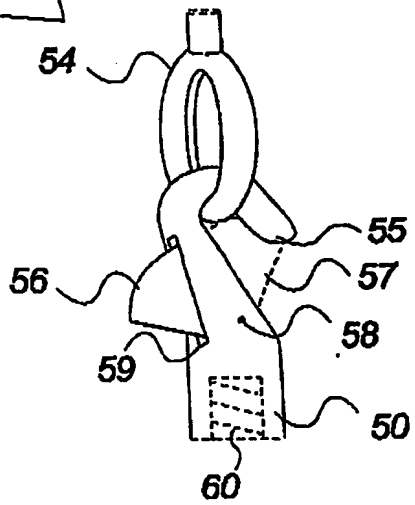

Fig. 9b

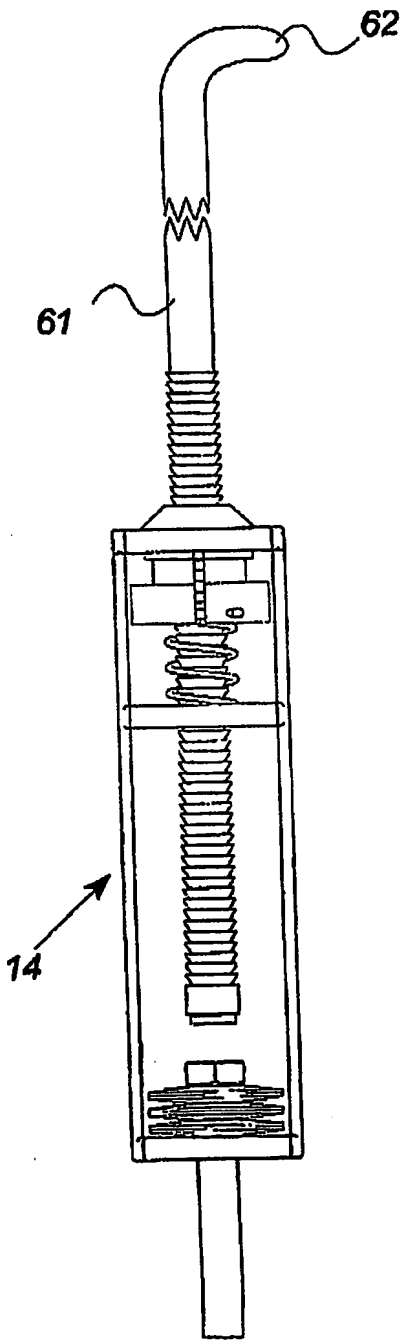

Fig. 10